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Impact of Piecing Index on Combed Yarn Quality

A. Muralikrishnan

Lecturer, P.A.C. Ramasamy Raja Polytechnic College, Rajapalayam, Tamil Nadu, India

ABSTRACT

After combing operation is completed, the detaching rollers feedback a part of the previously formed web. The nippers swing forward and lay the just-combed fringe onto the web portion projecting from the detaching rollers. This is called piecing of web in comber machine. Many parameters such as fibre properties, machine settings and process parameters affect the piecing and thus yarn quality. In this paper, the effect of piecing index on combed yarn quality was studied. Conventional and high-speed comber machines were chosen and samples were taken by changing various piecing index. Based on the study, piecing index influences the sliver U%, yarn IPI and classimat faults. Smaller variation in piecing index severely affects the sliver and yarn quality and no rule to determine the optimum piecing index for a particular process.

KEYWORDS: *Comber, Piecing index, High speed combers, Combed yarn*

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INTRODUCTION

The comber machine is used to produce medium and finer yarns and enables to improve the primary yarn characteristics of evenness, strength, cleanliness, visual appearance, and handle. In addition, comber is used to improve the working behaviour of yarn in downstream processing. To achieve, these requirements, the comber must perform the operations such as elimination of short fibres, impurities and neps. Parameters influencing the combing operation are raw material, lap preparation, factors associated with the machine, machine setting and ambient conditions. After combing operation is completed, the detaching rollers feedback a part of the previously formed web. The nippers swing forward and lay the just-combed fringe onto the web portion projecting from the detaching rollers. This is called piecing of web in comber machine. When the detaching rollers rotate in the web take-off direction again, they draw the just-combed fibres through the top comb and a new web section is formed. In order to carry out the piecing operation, the detaching rollers is used which two pairs of rollers and have three types of movement in comber. i.e. Backward motion, fast forward motion and normal forward motion. Backward motion to detaching roller is necessary for piecing operation in order to overlap new combed web into already combed web.

Fast forward motion of detaching roller is necessary for fast emerging of pieced web towards outside. Normal forward motion of detaching roller is necessary for delivering continuous web sheet to table calendar roller to make a sliver. These forward and backward motions of steel detaching rollers are achieved by means of a differential gear unit at the headstock in the modern combers. The delivery during forward movement is larger than the backward movement so that an effective take-off is achieved. In Rieter E7/5 comber, delivery length of web during forward and backward movements are 81mm, 49.5mm respectively and net delivery length of web during each combing cycle is 31.5mm. The cross-sectional view of combing elements are shown in figure 1.

Top detaching rollers are generally rubber rollers and pneumatically weighted. A horizontal flat link is provided above neck of detaching rollers. Pressure guide plates and flat link are completely enclosed in a housing and therefore protected from dust and fly. Pressure on top detaching roller can be varied by means of reduction valve. Normally the pressure applied on top detaching roller is 3 – 5 kg/cm^2. Piecing is a distinct source of faults in the operation of comber, but it is system related due to the discontinuous combing operation. The sliver produced in this way has a wave like structure, i.e. it exhibits periodic thick and thin variations. Based on hand book of uster tester, The wave length of variation = Piecing distance x total draft. These variations can be visualized in spectrogram of combed sliver at wavelength range of 30 to 75 cm.

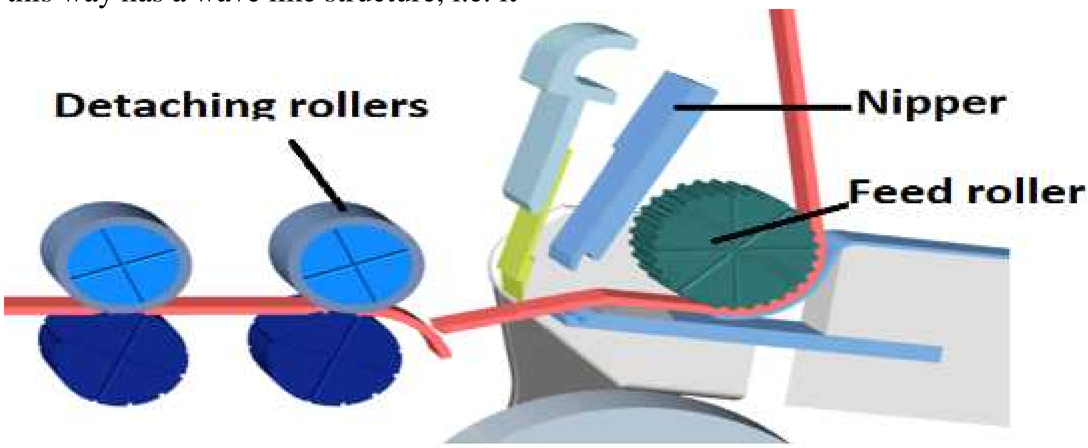


Figure 1 Cross sectional view of combing elements

MATERIALS

Bunny, MCU-5, S6 and DCH32 cotton varieties with the following proportion were taken for this trials: 35%, 35%, 15% and 15%. Fibre properties are measured in USTER HVI 1000 tester are listed in: 2.5% Span length - 30.5mm; SFI-5.27; Uniformity Index –84.09; Strength -33 grams/tex; Fineness-4.2 and Elongation – 6.35%.

Preparation of samples

The prepared cotton mixing was processed through blow room, carding, draw frame and unilap machines and comber laps were prepared. Ideal spinning preparatory machinery sequence with ideal process parameters were followed during sample preparation. The Prepared comber laps were processed through high-speed modern combers with different process parameters. The combed slivers were processed through finisher draw frame, speed frame and ring frame to produce yarn samples. The details of process parameters and production details of different trials conducted at different category of combers are shown in Table 1.

Table 1: Details of various process

Card Sliver Hank	0.120 Ne
Card waste%	7%
Lap Weight	70 g/m
Comber Waste%	20%
Roving hank	1.1 Ne
Ring Frame - Count	60 Ne
Ring Frame – TM	4.1
Ring Frame TPI	32

METHODOLOGY

In order to study the effect of smaller variation in piecing index on over all yarn quality, the two comber machines such as Rieter E75 and Cherry VC 250 with different speed and parameters are chosen for trials. In Rieter E75 comber, samples collected from piecing index of 0.0, -0.2 and -0.4. In Cherry VC250 comber, samples collected from piecing index of 3.9, 4.2 and 4.5. In mill condition, trial and error method is followed by changing various piecing index to get the optimum piecing index value.

PREPARATION OF YARN SAMPLES

The fibres from comber lap and comber sliver were tested for 2.5% span length and 50% span length using AFIS instrument. The prepared cotton mixing was processed through blowroom, carding, draw frame and unilap machines and comber laps were prepared. The Prepared comber laps were processed through high-speed modern combers with different piecing indexes. The noil% was measured by the following method. The machine was run at slow speed to clean the circular comb. The comber noil collection box, the suction pipe and the top comb were cleaned. The machine was allowed to run at operating speed for a period of 15 seconds. The comber noil and sliver were collected.

$$Noil\ \% = \frac{Weight\ of\ noil}{Weight\ of\ noil + weight\ of\ sliver}\ x\ 100$$

The sliver and yarn samples were collected and tested for unevenness in Uster eveneness tester 4. The yarn samples were also tested for classimat faults in Uster classimat tester and listed in table 2.

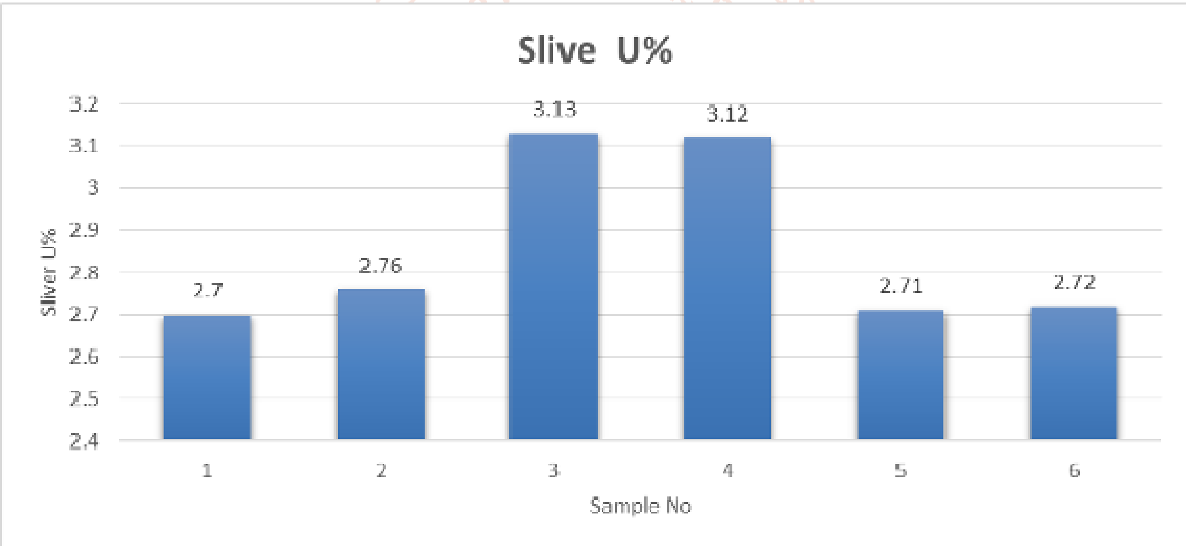
Table 2: Test results of various samples

Sample No.	Comber Make	Piecing index	Sliver U%	Yarn imperfections / Km – 60 Ne			Offline classimat faults /300 KM	
				Thin -50%	Thick +50%	Neps + 200%	Total	Long thin
1	Rieter E75	0	2.7%	1.0	21.0	75.5	48.7	2.7
2	Rieter E75	-0.2	2.76%	2.3	28.8	25.0	31.5	1.0
3	Rieter E75	-0.4	3.13%	1.5	79.5	86.8	56	4.3
4	Cherry VC 250	3.9	3.12%	1.0	21.5	53.8	92.7	10.7
5	Cherry VC 250	4.2	2.71%	4.3	32.5	71.5	62.7	9.3
6	Cherry VC 250	4.5	2.72%	3.5	34.8	63.5	88.7	8

RESULTS AND DISCUSSION

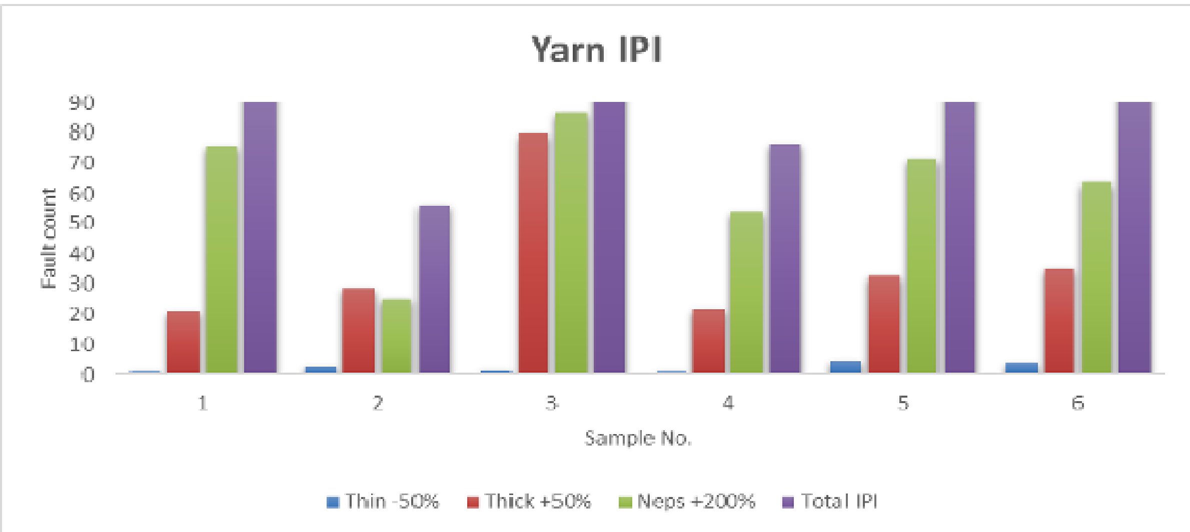
COMBER SLIVER UNEVENESS%

The sliver U% of samples 1,2,5 & 6 were found lower and sample 3&4 were found higher. This may be because of improper length of piecing in the combed web. Piecing index is a good indicator to achieve lower combed sliver unevenness%.

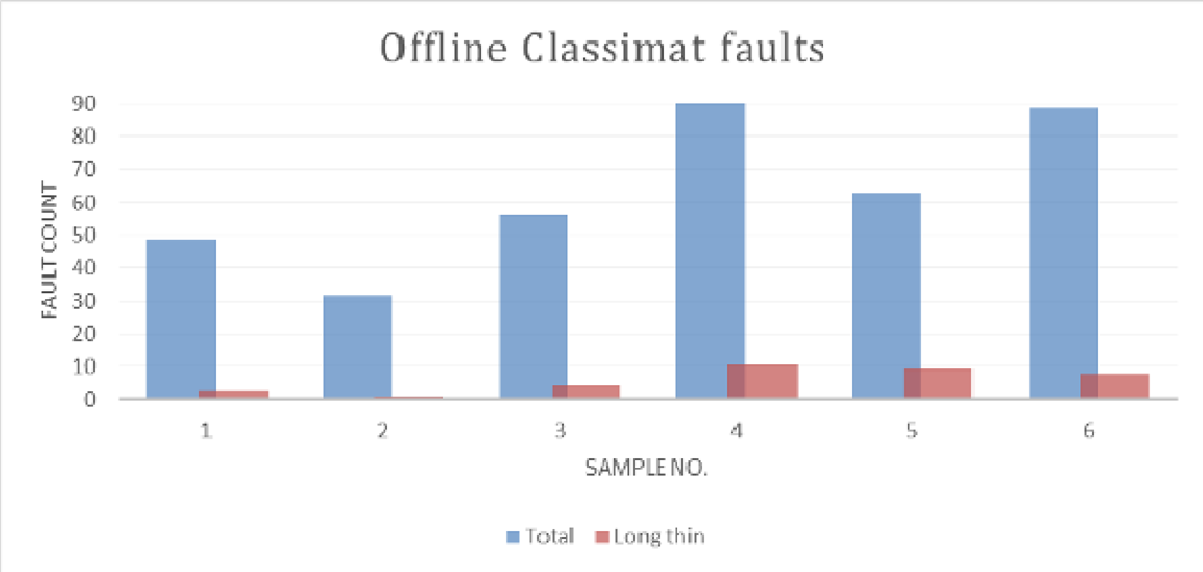


YARN IPI AND CLASSIMAT FAULTS

IPI level of Rieter combers, sample 1 shows minimum yarn imperfection when compared to sample 2 & 3. In Cherry combers, sample 4 shows minimum yarn imperfection when compared to 5 & 6.



In Rieter comber, sample 2 shows minimum classimat faults when compared to 1 & 3. Though there is a small variation in the above trial, the classimat faults are increased in the range of 55 – 77%. Similarly sample 2 shows less number of long thin faults. In Cherry combers, sample 5 shows minimum classimat faults when compared to sample 4 & 6. Though there is a small variation in the above trial, the classimat faults are increased in the range of 42 – 48%. Similarly, sample 6 shows less number of long thin faults compared to sample 4 & 5. It is varied only about 13 – 16%, so it is not a major variation in a mill.



CONCLUSION

In this paper, effect of piecing index on yarn quality have studied successfully and observed that the unevenness% of combed sliver and yarn properties were strongly affected by piecing index. The smaller variation in piecing index value shows a large difference in the yarn results. This trend was observed in the both the combers at slow and fast speeds but the effects of piecing index is not linear. Hence, the determination of optimum piecing index value is more important to get the desired yarn quality. Therefore, mills must take a trial at initial stage of new mixing/new process change to determine the optimum piecing index value.

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